Failed State: Reconstruction of Domestic Fisheries Catches in Somalia 1950–2010*

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Abstract

Somalia is a country in north eastern Africa that has suffered a high degree of political and social instability since the collapse of its last national government in 1991. This study reconstructed domestic fisheries catch data between 1950 and 2010, including the industrial, artisanal, subsistence and recreational sectors. We found that the Somali reconstructed total catch was nearly two times the landings reported by the FAO on behalf of Somalia, most of which was attributed to the reconstructed small-scale sector. Although there was an initial decline in catches after the collapse of government, small-scale catches strongly increased after the mid-1990s, as a result of increased private investment in artisanal fisheries, changes in seafood consumption habits and population displacement to the coast due to the civil war. However, the absence of monitoring and enforcement in Somali waters, coupled with the lack of transparency amongst international monitoring agencies in the Indian Ocean, resulted in a lack of reliable data for the significant level of illegal and semi-illegal foreign fishing activity also taking place in Somalia's Exclusive Economic Zone. Therefore, such activities were not included in this study.

Introduction

The Federal Republic of Somalia (referred to here as 'Somalia') is located on the Horn of Africa, has an extensive Exclusive Economic Zone (EEZ; over 830,000 km², i.e., the 5th largest Exclusive Economic Zone (EEZ) of any country in Africa; www.seaaroundus.org), and is bordered in the north by the Gulf of Aden and in the east by the Indian Ocean (Figure 1). The marine ecosystem is characterized by seasonal monsoons driving a strong south-north current along the east African coast, resulting in a significant upwelling off the coast of northeast Somalia. This system is highly productive, but the great quantity of small pelagic fish usually found in upwelling areas (Rykaczewski and Checkley 2008) does not occur to the same extent in the upwelling area off Somalia. However, the region is known for the seasonally high abundance of large pelagic fish (tuna and billfishes) that has attracted distant-water fleets (mainly from Europe and East Asia) to fish for these high value species (Bakun *et al.* 1998). In contrast, the environmental conditions have not been quite as favorable for the domestic fisheries sector; the coast does not have many natural harbours, and climate and ocean features give rise to large variation in the available resources between seasons and years (Haakonsen 1983). The Somali people have historically had a nomadic or agro-pastoral culture (Mukhtar 1996; UNEP 2005), similarly to other countries in the region, e.g., Djibouti; see Colléter *et al.* this volume). Thus, despite their abundant fish resources, the Somalis in general have had very limited interest in fishing[1] and their seafood consumption is thought to be among the lowest in the world. However, the coastal communities have a tradition of fishing, but the fraction of fishers compared to the total population has always been small (UNEP 2005).

Figure 1. The Exclusive Economic Zone (EEZ) of Somalia, based on general UNCLOS principles, and the shelf waters to 200 m depth.

Somalia gained its independence in 1960, when the former colonial territories of Italian Somalia and British Somaliland united and became the Somali Republic. During the 1960s, two elections were held. In 1969 the sitting president was assassinated and Mohamed Siad Barre came into power (UNEP 2005). He declared Somalia a socialist state, and the establishment of co-operatives became the basis for the socio-economic development in the country

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[1] Fish has actually been considered as unfit for human consumption in many parts of Somalia (Simoons 1974).

(Laitin and Samatar 1984). Despite the introduction of around 500 mechanized boats in the early 1970s, the lack of any fishing tradition and poor maintenance resulted in poor outcomes (Anon. 1982; FAO 2005a). In the late 1980s, a civil war started in the northwestern part of Somalia, and in 1991 the Siad Barre regime ended. The fight among different clans for power and control of the capital city of Mogadishu and other areas has impacted the country ever since. In 1991, former British Somaliland in the northwest claimed independence (as 'Somaliland'), and in 1998 the northeastern part of Somalia claimed an autonomous state of Puntland (UNEP 2005). Neither Somaliland nor Puntland have been recognized by the international community (UNEP 2005). The population in Somalia was about 2.2 million at the time of independence in 1960, and in the most recent census in 1986, it was 6.4 million (www.populstat.info; accessed January 2010). Due to the fighting, recent population numbers are highly uncertain and range from about 8–10 million (Kelleher 1998; Anon. 2009b).

After the fall of the Siad Barre regime in 1991, Somalia was not able to effectively manage its natural resources due to the lack of effective national governance (Kelleher 1998; Jennings 2001). Although foreign fishing in the offshore waters off Somalia was prevalent during the early decades from 1950 to 1980, no major illegal fishing incidents or confrontations with foreign vessels was reported during that time period (Sabriye 2005). Given that EEZs were not internationally recognized until the late 1970s or early 1980s, and Somalia's status and recognition of their claim for jurisdiction beyond 12 nm territorial waters remains uncertain and challengeable (but see below), any such offshore fishing was only considered 'illegal' in the context of international law with the ratification of UNCLOS by Somalia in 1989. As Somalia declared a 200 nm *territorial* sea in 1971 that is contested and not based on accepted international law (Schofield 2008), but ratified UNCLOS in 1989, this ratification could be argued to supersede Somalia's previous territorial sea claim and replace it with a legitimate 200 nm EEZ since 1989 (C. Schofield, *pers. comm.*). Furthermore, the effective collapse of the national government in 1990 also exposed its coastal waters to uncontrolled access by foreign fleets (Samatar 2007). During the post-regime period, the state failed to exercise its rights both at land and sea due to a dysfunctional government (Dupont 2003).

Several issues contributed to the problem with unregulated and unlicensed fishing vessels. The majority of Somalia's maritime neighbours are not equipped with adequate monitoring, control and surveillance infrastructure to address violations by foreign fishing vessels. This includes Kenya (Anon. 2008a,b,d; also see Le Manach *et al.* this volume), Tanzania (Anon. 2008e; also see Bultel *et al.* this volume),[2] and Yemen (Anon. 2009a). None of these countries have regular or adequate fisheries observer schemes, port state control, mandatory vessel monitoring system requirements or aerial surveillance for foreign vessels operating in their own EEZs. After the fall of Siad Barre regime in the early 1990s, the majority of Somali licensed foreign vessels re-flagged their vessels to Kenya or Flag of Convenience countries (e.g., Belize, Honduras) to conduct illegal fishing operations in Somali waters (Kulmiye 2001; Anon. 2008c). Starting in the mid 1990s, foreign illegal fishing vessels started encountering increasing resistance from local clans along Somalia's coastline, and started paying local warlords and militia a nominal amount for protection to fish in local waters. The majority of fishing vessel arrests locally during this time appear to be for failing to pay the clans for illegal fishing, rivalries between two clans claiming authority over the same territory (Anon. 2005; von Hoesslin 2006) or for fishing too close to the coast (Anon. 1998).

For the purpose of the present catch reconstruction, we did not deal with the illegal foreign fishing presence in Somali waters, despite its historic significance and likely massive scale. Data presented here pertain only to domestic Somali fisheries and licensed foreign and joint venture operations.

Material and Methods

Fisheries development

Of the two former colonial powers, the United Kingdom and Italy, only Italy is known to have tried to establish a fishing industry (e.g., by building three canning factories on the north shore in the mid-1930s), but without much success (Haakonsen 1984). After independence in 1960, the fisheries sector was not paid much attention until Siad Barre came to power in the late 1960s. To increase fisheries production, the government launched fisheries development programs and created about 20 fishing co-operatives that were supplied with, e.g., motorized boats, fuel, and fishing gear. In 1974, the nomadic population was heavily affected by a severe drought that killed much of their livestock. Consequently, fifteen thousand nomads were resettled into four fishing co-operatives. The fisheries development programs were largely supported by the former Soviet Union.

Pre-1991: industrial and foreign fishing

Somalia has never had a large domestic industrial fishing fleet, and most of the industrial fishing in Somali waters has been carried out by what were essentially foreign fleets, for many years through so-called 'joint ventures'. During the 1950s, the Italians were fishing mostly for their canning industry on the north coast, with 95% of the production exported to Italy and the remainder marketed locally or sent to Yemen. Occasional Japanese longlining occurred offshore on the east coast (Johnson 1956), and in the 1960s, Japan undertook test fishing for tuna (Lawson *et al.* 1986). Some Greek trawlers also operated in Somali waters in the mid-1960s (Haakonsen 1983). In 1974, SOMALFISH was established as a joint venture between Somalia and the Soviet Union. It operated ten trawlers and one fishmeal factory ship until late 1977, when political relations between the two countries broke down and the

[2] "Tanzania, SADC join forces against illegal fishing". Available at: www.stopillegalfishing.com [Accessed in February 2010].

Soviet Union withdrew their boats and support (Haakonsen 1983). According to national statistics, these vessels caught 2,000–5,000 t·year^{-1} of finfish and spiny lobster (FAO 1978; Haakonsen 1983). However, according to Yassin (1981) SOMALFISH exported between 10,000–20,000 t·year^{-1}.

After the Soviets terminated their operations in Somalia, industrial fishing was carried out through joint ventures and licensing of foreign vessels from countries such as Italy, Japan, Greece, Singapore and Egypt (Van Zalinge 1988) as well as China.[3] SOMALFISH itself purchased two Australian-built shrimp trawlers and nine Yougoslavian-built trawlers (Lawrence 1980). The two Australian vessels started operating in the late 1970s, but it is unclear if the nine Yugoslavian trawlers ever operated (Haakonsen 1983). An Italian company called 'Amoroso e Figli' operated three freezer trawlers off the north east coast in 1978 and 1979 (Stromme 1987). SIDACO, a joint venture between Somalia and Iraq was formed in 1977 (FAO 1978). However, according to Haakonsen (1983), their vessels never operated, while another source stated that in 1982, SIDACO operated four trawlers (Anon. 1982). SOMITFISH, a joint venture between Somalia and Italy, operated three Italian-built trawlers between 1981 and 1983 (Van Zalinge 1988). In 1983, ten Japanese longliners were fishing for large pelagic fish, and in 1984 six Japanese and eighteen Korean longliners fished in Somali waters. In 1983 and 1984, Romanian trawlers fished for small pelagic fish as a scientific expedition. Italian and Japanese bottom trawlers as well as several pelagic pair trawlers from Singapore operated in Somali waters in late 1984 (Elmer 1985). In 1985, ten licenses were issued to foreign vessels from four different countries (Anon. 1987). After a few years of inactivity, SOMITFISH was re-established as SHIFCO, and with new and rehabilitated vessels started operations in 1987 (Anon. 1988; Sabriye 2005). In addition, five Italian trawlers and one French trawler were licensed to fish in Somali waters (Anon. 1988). During the 1980s, China increasingly supported the Siad Barre regime with direct supplies of weapons and other military supplies. In exchange, Somalia transferred fishing rights to China, which was formalized through an agreement signed in 1989. It is likely that with the fall of the Siad Barre in 1990, this fishing may have continued uncontrolled for some time.

Post-1991: collapsed government

The Siad Barre regime maintained a surveillance force to protect the offshore waters of Somalia, although nothing is known about its effectiveness. When the government collapsed in 1991, the waters were left unmonitored and unguarded, and this was exploited by fishing vessels from various countries (Qayad 1997; Jennings 2001; Mohamed and Herzi 2005; UNEP 2005; Mwangura 2006b; Samoilys *et al.* 2007; Schofield 2008; Weir 2009). This unlicensed exploitation by foreign vessels has been proposed as a major reason for the initial rise of piracy in the waters of Somalia (Lehr and Lehmann 2007). It is argued that local fishers who were deprived of their livelihoods, and the warlords who saw an opportunity to make money, formed 'coast guards' to enforce the waters of their perceived 'territories'. These 'coast guards' attacked foreign fishing vessels and demanded compensation for fish caught. Local warlords also started to sell 'licenses' for fishing (Jennings 2001; Menkhaus 2009), thus creating what can be called 'semi-illegal' licensing schemes for foreign vessels.

For example, in 1996–97, 43 longliners, 61 purse seiners and a few Kenyan trawlers were fishing in Somali waters through such local warlord agreements. In addition, four Saudi-Arabian trawlers and some Pakistani vessels occasionally fished along the coast, and three Sri Lankan vessels based in Berbera fished for sharks. Two Syrian and one Taiwanese vessel were captured and accused of illegal fishing by the 'Somali Salvation Army' (Kelleher 1998). In 2005, Somaliland had about 36 Egyptian trawlers operating in their waters, landing about twice as much as the small-scale fleet was assumed to land (Gulaid 2004). Interestingly, the remaining 'domestic' industrial fleet (operating under the joint venture SHIFCO) had been operating out of Aden (Yemen) since the late 1990s (Jennings 1998; FAO 2005).

Small-scale fisheries

The small-scale fisheries development programs during the Siad Barre era were not only supported by the Soviet Union, but by other countries through foreign aid. However, the desired growth of the sector failed to materialize. The absence of fishing traditions translated into a lack of fishing experience and infrastructure such as storage and processing facilities. There was also a lack of equipment and knowledge on how to repair boats, which made it hard to maintain the fishing fleet. For example, more than 50% of the new motorized boats distributed in the mid-1970s were out of commission after only a few years. The marketing of fish from the co-operatives was centralized during the 1970s and early 1980s, diminishing incentives for increased production (Haakonsen 1983). Fishing activities increased when the government started to liberalize the sector during the 1980s (Pierconti and Dunn 1990).

After the collapse of the central government in 1991 and during the ensuing civil war, much of the existing small-scale fishing sector was reduced, which amplified the already existing shortage of spare parts and infrastructure. The small-scale fishers also suffered from the cessation of government support (Lovatelli 1996) and their catches declined (Kelleher 1998). However, in later years, the absence of government control of the fishing industry resulted in increased influence of the private sector and entrepreneurs, which was the main force behind the gradual revival of the fishing trade (Lovatelli 1996). In more recent times, the investment from the private sector together with foreign aid, and also the change in consumption habits of Somalis seem to have resulted in an expansion of the small-scale fisheries sector and substantially increased small-scale catches in the post-war period (Gulaid 2004; Mohamed and Herzi 2005; Sabriye 2005).

[3] Country Studies Series by Federal Research Division of the Library of Congress. Available at www.country-data.com/cgi-bin/query/r-12055.html [Accessed August 2012].

Lack of statistics and reliable data

Lack of sufficient and reliable statistics was identified as a major problem for the development and management of fisheries in the Indian Ocean (IOFC 1982). The Somali Ministry of Fisheries does not seem to have had a tradition of collecting fisheries statistics. For example, Elmer (1985) reported that it was difficult to make the Ministry pay the people responsible for gathering of data, as there was a lack of understanding of the importance of data collection. The national legislation in Somalia (i.e., the Maritime Code) also hindered the gathering of fisheries statistics since it did not give the Ministry of Fisheries the authority to collect fishing data. The national statistics law did cover data collection to some extent, however, it did not include provisions ensuring the Ministry of Fisheries would receive data on fisheries (Lawrence 1980). The absence of workable government institutions since the late 1980s prolonged and exacerbated the problem of unreliable data (UNEP 2005).

The existing fisheries statistics from the 1970s and the 1980s are thought to be incomplete. For example, the 'production from all sectors' in 1985 as reported by the Somali government (Anon. 1985), was based solely on catches by the 23 co-operatives and re-settlements, the offshore catches, and the purchases by companies from small-scale artisanal fishers. The reported production from the cooperatives and re-settlements was deemed to represent the artisanal (i.e., small-scale, commercial) production and was reported as 6,223 t in 1985. This is thought to be an underestimate, since it excluded data from fishing villages along the coast that were not part of a co-operative. For example, Jennings (1998) reported 31 fishing communities, while Mohamed and Herzi (2005) suggested that before the civil war there were about 50 fishing villages. Furthermore, the FAO also reported in its country profile that there were about 50 fishing villages along the coast (FAO 2005). Hence, the artisanal fish production from villages that were not associated with the 20 co-operatives or the three re-settlements, together with non-commercial catch (i.e., subsistence catch), seemed to be missing from reported data. In addition, the Ministry of Fisheries acknowledged that a substantial part of the landed catch was sold directly at the beach landing sites to the public, and deemed the amount sold as 'unquantifiable' (Anon. 1987). Shaves (1984) also reported that sales of fish occurred outside the controlled market during the time when, according to national law, all fish had to be sold through the co-operatives at a fixed price.

Furthermore, the total production reported by the Ministry in 1985 was 11,938 t (Van Zalinge 1988). This included 2,039 t of artisanal landings that were purchased by public companies, 1,130 t of large pelagic fish caught by Korean longliners, and 240 t of small pelagic fish caught by Romanian survey trawlers (Van Zalinge 1988). If the artisanal catch component and the Korean and Romanian catches were subtracted, the remaining production (i.e., 8,529 t) matched what was reported as demersal industrial production (i.e., 8,528 t) in 1985 (Van Zalinge 1988).

The Food and Agriculture Organization of the United Nations (FAO) is mandated to report data provided by their member countries. The examples described above matched what FAO reported as Somali catch for 'marine fishes nei' in FAO FishStat for 1985. This suggests that FAO data for Somalia are incomplete due to the use of national data reported by the Somali Ministry of Fisheries.[4]

Discards

Industrial fisheries

Tropical waters have a large number of species, and one species rarely makes up more than 20% of the catch (Tussing *et al.* 1974). In Somali waters, there is a large diversity of fish, but only a few species are of commercial interest (Lovatelli 1996). Trawl surveys in the late 1970s reported non-commercial bycatch of more than 50% (Kelleher 1998). Van Zalinge (1988) reported that only the high value species, accounting for less than 50% of the catch, were retained on demersal trawlers. Therefore, discarding was likely high in demersal trawl fisheries. Depending on the species composition, the acceptability for various species by markets, onboard storage capacity, and distance to port, between 40% and 80% of the total catch was discarded (Tussing *et al.* 1974). In the shrimp trawl fishery, discards may have been as high as 90% (Hariri 1985). For later years, Kelleher (2005) reported that the general discard rates in the western Indian Ocean were 9% in the tuna fishery, 92.3% in the shark fin fishery, 30–40% in the long-range longline fishery, 5% in the purse seine fishery, and 21.7% in regular longline fisheries. Kelleher (2005) did not report a specific demersal trawling discard rate for the western Indian Ocean, but his global weighted average discard rate for demersal finfish trawling was 19.6%.

Small-scale fisheries

In the small-scale fishery, a large number of different species are fished and consumed (Mohamed and Herzi 2005), although pelagic species such as tuna and mackerel are commonly favoured (Costello *et al.* 2012). Furthermore, in some cases or areas, this fishery may focus on a narrow range of species for retention (UNEP 2005). Kelleher (2005) reported that east African artisanal fisheries have negligible discards. However, due to the eating habits of the Somalis, the lack of storage/processing facilities and market opportunities, some sources acknowledged that discarding occurred also in the small-scale fishery (e.g. Lovatelli 1996; Mohamed and Herzi 2005).

[4] As part of our search for information on Somali fisheries statistics, we attempted repeatedly to contact Mr. Graham Farmer who apparently is (or was) the officer in charge of the FAO Somali program, but without success.

Here, discarding by small-scale fisheries was considered negligible overall, and was not included in the catch reconstruction. Discarding of shark meat as part of the shark fin fishery, however, has been estimated here. Many of the small-scale fishers target shark for their fins and only a few of the fishers retain the meat (Lovatelli 1996).

Overall, we followed a catch reconstruction approach as described by Zeller *et al.* (2007), with the main purpose of comprehensively estimating total catches taken from the EEZ-equivalent waters of Somalia since 1950, by domestic fisheries.

Methods

Somalia's domestic fisheries

Landings data for Somalia supplied to FAO were reported as 'marine fishes nei', 'cephalopods nei' and 'tropical spiny lobster nei', and were assumed to represent industrial catches, the production from the co-operatives and purchases of some artisanal catches by smaller companies. Here, the total reported landings were assigned to small-scale and industrial fisheries based on a breakdown of landings between 1974 and 1987 reported by the Ministry of Fisheries (Van Zalinge 1988). For the years where no breakdown was available (prior to 1974 and after 1987) the averages of the first and last three years of the breakdown were used, respectively. Thus, prior to 1974, 25% of landings were assigned to industrial landings, and after 1987, 49% were assigned to industrial. 'Tropical spiny lobsters nei' were split using these proportions with no further adjustments made. The 'marine fishes nei' and 'cephalopods nei' were then added together and the total was split using the proportions listed above. This was done because all cephalopod catches were determined to be small-scale, and doing the split this way allows the total catch to be split using the determined proportions, while allowing allocation of a greater proportion of the 'marine fishes nei' to the industrial sector and all. This is addressed further in the description of the species breakdown below. The FAO data that were assigned to industrial fisheries were taken at face value, while a separate reconstruction of the small-scale fisheries allowed us to determine an add-on to the small-scale portion of reported FAO data derived here. For this reconstruction, we used the 2010 FAO data as our baseline.

Small-scale catches

Small-scale catches (i.e., artisanal and subsistence catches) were estimated using the number of operational boats and catch rate per operational boat per year. The earliest reported small-scale catch (Thurow and Kroll 1962) was taken at face value and extrapolated back to 1950. The most recent records of catches were reports for the fisheries in the three regions of former Somalia: southern central Somalia (Sabriye 2005), Puntland (Mohamed and Herzi 2005), and Somaliland (Gulaid 2004). The reported catches for Puntland and southern central Somalia were taken at face value. For the third region, Somaliland, shark catches were missing and were estimated based on the fraction of shark in catches in southern central Somalia. The estimated shark catch was then added to the reported fish catch for Somaliland (Table 1), and these data were used as the 2005 anchor point.

The total estimated small-scale catch for 2005 (Table 1) was carried forward to 2010 unchanged. For 1962, Thurow and Kroll (1962) report small-scale catches of 16,500 t, which we carried back to 1950 unaltered (Table 2). The small-scale catches in the period between 1963 and 2004 were estimated by deriving anchor points for the number of operational boats for 1978, 1980, 1988, and 1995 based on available information and assumptions (see below). The number of operational boats was then multiplied by a catch rate per boat based on Elmer (1985) to create anchor points for small-scale catch (Table 2). To complete the time series, linear interpolation was done between the derived catch anchor points and the catches reported in 1962 and 2005 (Table 2).

Table 1. Small-scale catches reported and estimated for 2005 for Somalia.

Region	Fish (t)	Shark (t)	Total (t)	Shark (%)	Source
South-central Somalia	14,825	6,113	20,938	29	Sabriye (2005)
Puntland	2,144[a]	8,990	11,134	81	Mohamed and Herzi (2005)
Somaliland	6,030	2,486[b]	8,516	29	Gulaid (2004)
Total Somalia	22,999	17,589	40,588	43	-

[a] A substantial part of the finfish catches from Puntland are sold to Yemen and not included in the reported catches for Puntland; [b] Estimated using the fraction of shark catches from south-central Somalia

Table 2. Anchor points used for interpolation of small-scale catch for Somalia. Values in italics are interpolated.

Year	Operational boats[a]	Catch anchor points (t)	Source
1950	-	*16,500*[b]	-
1962	-	16,500	Thurow and Kroll (1962)
1978	1,874	18,740[c]	Thurow and Kroll (1962), Haakonsen (1983)
1980	1,725	17,250[c]	Lawrence (1980)
1988	1,725	*17,250*[c]	-
1995	792	7,920[c]	Kelleher (1998)
2005	-	40,588[d]	Gulaid (2004), Mohamed and Herzi (2005), Sabriye (2005)
2010	-	*40,588*[e]	-

[a] See text for sources; [b] Assumed equal to 1962 value; [c] Based on average catch rate of 10 t·boat^{-1}·year^{-1} (Elmer 1985); [d] Estimated shark catches for Somaliland were added; [e] Assumed equal to 2005 value.

Number of operational boats

The traditional boats in Somalia are the wooden canoe called '*houri*', and the less common sail boats called '*beden*' or '*mashua*' (Lovatelli 1996). According to Thurow and Kroll (1962), the small-scale fishing fleet in the early 1960s

consisted of 1,875 *houris* (of which 1,500 were always active), 175 *beden* (of which 150 were always active), and 25 other boats (called '*dunnis*'), together accounting for a total catch of 16,500 t (Table 2). Thus, the fraction of traditional boats that were operational at any one time was about 80%. This fraction was applied to the reported total number of traditional fishing boats in later years (see below).

During the 1970s, a number of motorized boats were issued through fisheries development programs. Haakonsen (1983) reported that 685 motorized boats had been provided during the previous years and that 500 of those boats were issued during the five year development program 1974–1978. According to Hariri (1985), 700 motorized boats were issued from 1972 onwards, and by the late 1970s only 40% were working. UNDP/FAO (1992) reported that 600 motorized boats were issued between 1974–1978 and that in 1979, 150 new engines were provided by the UK to rehabilitate some of these boats. Jennings (1998) reported that 600 motorized boats were issued and that within five years only 20% were working. According to Lovatelli (1996), 450 boats had been issued by 1982. As the number of motorized boats reported by the above sources are all in the same range, we used the earliest source (i.e., Haakonsen 1983). The year 1978 is in the middle of the ten year period reported on by Haakonsen (1983) for the distribution of 685 boats, hence we assumed that all boats were distributed by 1978 to create an anchor point. By the time the report was written (1983), more than 50%, and maybe as much as 75%, of the distributed motorized boats were not operating due to lack of spare parts and knowledge on maintenance (Haakonsen 1983). Hence, we assumed that 40% were working and applied this to the total number of motorized boats to derive a total of 274 operational motorized boats for 1978 (i.e., 685 × 0.4 = 274).

The traditional boats are thought to have had a much higher fraction that were operational, due to lower mechanization and easier, more traditional maintenance requirements. Therefore, the fraction of operating traditional boats (80%) from Thurow and Kroll (1962) was used. Haakonsen (1983) reported that the traditional fleet was 2,250 boats, but he also mentioned that use of traditional boats was declining due to the introduction of motorized boats and lack of maintenance. Therefore, for 1978, we assumed 2,000 traditional boats and a working rate of 80%. Together with the assumed 274 working motorized boats, this resulted in an anchor point in 1978 of a total of 1,874 operational boats (Table 2).

In 1980, Lawrence (1980) reported that about 125 motorized boats were working and that the traditional fleet was about 2,000. Hence, we derived a 1980 anchor point of 1,725 working traditional and motorized boats ([2,000 × 0.8] + 125 = 1,725; Table 2).

In 1988, the civil unrest started in northern Somalia, and by 1991 the government had collapsed. The civil war damaged much of the fishing sector; hence, there was a decline in the number of operational boats after 1988. Due to lack of other information, the anchor point in 1980 was carried forward to 1988 (i.e., 1,725 operational boats; Table 2).

Kelleher (1998) reported that the artisanal fleet in 1995 was made up of 627 *houris* and sailboats (i.e., 627 × 0.8 = 502 operational traditional boats) and 290 functional motorized boats. This was used to form an anchor point of 792 operational boats in 1995 (Table 2).

Catch rate

Elmer (1985) reported that around 737 operational boats caught 8,288 t. Thus, the average catch rate was 11.25 t per operational boat per year (8,288 / 737 = 11.25). To remain conservative, we used a catch rate of 10 t per operational boat per year as a default measure to derive the estimated tonnage of small-scale catch for 1978, 1980, 1988 and 1995 (Table 2). For years between anchor points, data were linearly interpolated.

Small-scale catches: artisanal *versus* subsistence

Although the majority of data sources used here for estimating small-scale catches related to artisanal fisheries, we assumed that a fraction of these catches could be deemed subsistence, i.e., were not for sale but for direct consumption or local barter. Thus, we assumed that the estimated total small-scale catches derived here were split into the two sectors as follows: For 2010, we assumed 80% artisanal and 20% subsistence, while for 1950 we assumed a 60% artisanal and 40% subsistence split. We interpolated these percentages over time to derive full time-series for each sector.

Species composition

We assigned the estimated catch to different species, by sector, based on information found in various sources (see Table 3).

Industrial catch

The domestic industrial catch was assumed to consist of demersal species caught by trawl (80%), and pelagic species (20%). The pelagic catch was in turn split between large (80%) and small (20%) pelagic taxa. Individual taxa were assigned percentages within each category (Table 4) based on the general information contained in the sources in Table 3.

Small-scale catch

Much of the literature suggested that sharks and rays made up a substantial part of the small-scale catch (artisanal sector only; shark fishing assumed to be a commercial endeavour); therefore they were treated as their own category. Thurow and Kroll (1962) reported that sharks made up 21% of the total catches in the early 1960s. The fraction of sharks and rays in the small-scale catch increased to about 40% during the 1980s (Anon. 1987), and to 55–65% by the 1990s (Lovatelli 1996). We assumed 55% of the catch in the mid-1990s was sharks. For each of these anchor points, in order to be conservative, it was assumed that these percentages applied to the artisanal catch only. For the most recent time periods, the fraction of sharks was 29% of the total small-scale catch in southern central Somalia (Sabriye 2005), whereas in Puntland it was 81% of the reported catches, although substantial finfish catches were missing from the data (Mohamed and Herzi 2005). We estimated the shark catches in Somaliland by assuming the same shark to finfish ratio as for south-central Somalia (i.e., 29%; Table 1), and added them to the reported artisanal catches (Gulaid 2004), which resulted in a total fraction of sharks of 43% in 2005 for Somalia (Table 1). Considering that the Puntland percentage was an over-estimate and that the Somaliland tonnage had to be estimated, we applied the 43% in 2005 to the artisanal catch only, in order to remain conservative. Note that this in turn resulted in a slightly lower shark tonnage for 2005 within our reconstruction than was found in the literature. All of this information was used to create a time series of the shark and ray fraction within the artisanal sector. Linear interpolation was done between the anchor points in 1962 (21%), 1985 (40%), 1995 (55%) and 2005 (43%). Data for 1962 was carried back to 1950 unaltered and the anchor point in 2005 was carried forward to 2010 unaltered. Species composition of shark catches were derived from a variety of sources (Table 3) and applied in seven taxonomic groups (3 species, 2 families and 2 general groupings, Table 5).

Table 3. Sources used for species composition for the catch reconstruction for Somalia, by fishing sector.

Source	Fisheries sector				
	Industrial	Artisanal	Pelagic	Demersal	Sharks & rays
Corfitzen and Kinzy (1950)					✓
Ogilvie *et al.* (1954)		✓	✓	✓	
Johnson (1956)		✓	✓	✓	
Thurow and Kroll (1962)	✓	✓			✓
Losse (1970)		✓	✓	✓	✓
FAO (1972)	✓	✓			
FAO (1978)		✓			✓
Anonymous (2011)		✓	✓	✓	✓
Bihi (1984)	✓	✓			
Johnsen (1985)	✓			✓	
Anonymous (1985)		✓			✓
Van Zalinge (1988)	✓	✓	✓	✓	
Sanders and Morgan (1989)	✓	✓	✓	✓	
Lovatelli (1996)		✓	✓	✓	✓
Marshall (1997)		✓			✓
Kelleher (1998)	✓	✓	✓	✓	✓
Jennings (1998)	✓	✓	✓	✓	✓
Anonymous (2004)		✓			✓
Sabriye (2005)		✓			✓
UNEP (2005)	✓	✓			✓
IUCN (2006)		✓			
IOTC database[a]	✓		✓		

[a] Indian Ocean Tuna Commission (IOTC) database available at www.iotc.org/English/index.php [Accessed: March, 2011]

The remaining, non-shark artisanal catch was split into demersal (40%) and pelagic (60%) catches, based on information from sources in Table (3). Artisanal finfish catch is thought to be dominated by pelagic taxa (60%), in contrast to industrial catch, in which demersal taxa (80%) predominate (Tables 4, 6). Individual taxonomic assignment of catches (Table 6) was derived from sources in Table 3.

The breakdown for the subsistence catches was derived from the artisanal breakdown, taking into account sectoral differences. Sharks and rays were excluded and the proportion of large pelagic fish was greatly reduced. Subsistence catches were disaggregated using the proportions shown in Table 9.

Table 4. Species breakdown of industrial catches for Somalia, as derived for the present study, based on qualitative information from sources listed in Table 3. Percentage breakdown relates to the total industrial catch.

Category	Size[a]	Family/group	Species	Common name	Industrial catch (%)
Pelagic	Large	Scombridae	*Thunnus albacares*	Yellowfin tuna	7.7
Pelagic	Large	Scombridae	*T. obesus*	Bigeye tuna	5.9
Pelagic	Large	Istiophoridae	*Tetrapturus audax*	Striped marlin	0.7
Pelagic	Large	Istiophoridae	*Makaira mazara*	Indo-Pacific blue marlin	0.3
Pelagic	Large	Xiphiidae	*Xiphias gladius*	Swordfish	0.4
Pelagic	Large	misc. billfish	-	Other billfish	0.1
Pelagic	Large	misc. pelagic fishes	-	Pelagic fishes	0.9
Pelagic	Small	Clupeidae	*Sardinella longiceps*	Indian oil sardine	1.9
Pelagic	Small	Clupeidae	*Etrumeus teres*	Round herring	0.8
Pelagic	Small	Scombridae	*Scomber japonicus*	Chub mackerel	0.8
Pelagic	Small	Carangidae	*Decapterus* spp.	Scad	0.3
Pelagic	Small	misc. pelagic fishes	-	Pelagic fishes	0.2
Sub-total pelagic					20.0
Demersal		Lethrinidae	*Lethrinus nebulosus*	Spangled emperor	11.3
Demersal		Lethrinidae	*L. lentjan*	Pink ear emperor	5.7
Demersal		Lethrinidae	*L. olivaceus*	Longfaced emperor	5.7
Demersal		Lethrinidae	-	Misc. emperors	5.7
Demersal		Serranidae	*Epinephelus areolatus*	Areolate grouper	10.4
Demersal		Serranidae	-	Misc. groupers	2.6
Demersal		Lutjanidae	*Etelis* spp.	-	4.1
Demersal		Lutjanidae	*Aprion* spp.	-	4.1
Demersal		Lutjanidae	-	Misc. snappers	2.0
Demersal		Haemulidae	*Diagramma pictum*	Painted sweetlips	19.0
Demersal		Mullidae	*Parupeneus indicus*	Indian goatfish	9.4
Sub-total demersal					80.0
Total					100.0

[a] Large = 80%, small =20% of the pelagic fraction of the industrial catch.

Catches reported to FAO included cephalopods. However, there was no specific information on cephalopod catches in our sources. Therefore, the reported cephalopod catches were proportionally assigned to the artisanal and subsistence sectors using the same proportional split applied to the total small-scale catches. The tonnage determined for each sector was then assumed to be contained within the 'marine fishes nei' tonnage that was estimated above and subtracted out to determine the remaining amount of 'marine fishes nei' for each sector.

Table 5. Species breakdown of small-scale shark and ray catches for Somalia, based on sources in Table 3.

Category	Family	Species	Common name	Catch (%)
Sharks	Carcharhinidae	*Carcharhinus melanopterus*	Blacktip reef shark	15.0
		C. amblyrhynchos	Grey reef shark	7.5
	Alopiidae	*Alopias vulpinus*	Thintail thresher	15.0
	Lamnidae	-	Mako sharks	15.0
	Sphyrnidae	-	Hammerhead sharks	15.0
	-	-	Other sharks	7.5
Rays	-	-	Rays and mantas	25.0

Table 6. Species breakdown of artisanal catches (excluding sharks and rays) for Somalia, based on qualitative information from sources listed in Table 3.

Category	Family	Species	Common name	Catch (%)
Pelagic	Scombridae	*Thunnus albacares*	Yellowfin tuna	15.0
		T. tonggol	Longtail tuna	5.0
		Euthynnus affinis	Kawakawa (Little tuna)	5.0
		Scomberomorus commerson	Narrow-barred Spanish mackerel	10.0
		-	-	5.0
	Clupeidae	*Sardinella longiceps*	Indian oil sardine	4.0
		-	-	1.0
	Carangidae	*Selar crumenophthalmus*	Bigeye scad	2.0
		Trachurus indicus	Arabian scad (Horse mackerel)	2.0
		-	-	1.0
	Coryphaenidae	*Coryphaena hippurus*	Common dolphinfish	5.0
	Istiophoridae	*Tetrapturus audax*	Striped marlin	1.7
		Makaira mazara	Indo-Pacific blue marlin	0.8
	Xiphiidae	*Xiphias gladius*	Swordfish	2.0
	Misc. billfish	-	Other billfish	0.5
Sub-total pelagic				60.0
Demersal	Lethrinidae	*Lethrinus nebulosus*	Spangled emperor	8.0
		L. lentjan	Pink ear emperor	4.0
		L.olivaceus	Longfaced emperor	4.0
		-	Emperors	4.0
	Lutjanidae	*Etelis* spp.	-	2.0
		Aprion spp.	-	2.0
		-	Snappers	1.0
	Serranidae	*Epinephelus areolatus*	Areolate grouper	4.0
		-	Groupers	1.0
	Mullidae	*Parupeneus indicus*	Indian goatfish	2.5
	Misc. marine fish	-	-	7.5
Sub-total demersal				40.0
Total				100.0

Discards

Industrial fisheries

Due to a lack of gear specific information in the Somali domestic industrial fisheries, we assumed that half of the pelagic fish in the industrial catch was caught with longliners and half with purse seiners, and applied associated discard rates (21.7% for longliners and 5% for purse seiners) reported by Kelleher (2005). For the demersal fraction of the domestic industrial catch, the global average discard rate for demersal finfish trawlers of 19.6% (Kelleher 2005) was used, as specific discard rates for demersal fisheries in the western Indian Ocean were not available. The bycatch of sharks in industrial trawlers has been estimated to be 5% of the total weight of the catch. Of this bycatch, only the fins were kept and the rest was discarded (Marshall 1997). The discard of shark meat was assumed to be included as part of the 19.6% discard rate. The demersal discard rate was split between sharks (4.5%) and fishes (15.1%). The sharks were taxonomically disaggregated using the artisanal shark breakdown, and fishes were disaggregated by family using the industrial demersal breakdown (Table 7). Pelagic discards were broken down using the proportions shown in Table 8.

Table 7. Breakdown by family name for industrial demersal fish discards.

Family	Percentage
Lethrinidae	28.4
Serranidae	13.0
Lutjanidae	10.2
Haemulidae	19.0
Mullidae	9.4

Table 8. Breakdown by family name for industrial pelagic discards.

Family	Percentage
Scombridae	20.0
Istiophoridae	20.0
Coryphaenidae	20.0
Clupeidae	20.0
Marine fishes nei	20.0

The crustacean fishery incurred a small amount of discards as well. Discards were estimated to equal 1.1% of the crustacean landings.

Small-scale fisheries

Although references have been made to some discarding of fish in the small-scale fisheries (e.g., Lovatelli 1996; Jennings 1998; Mohamed and Herzi 2005), they may be low (except for artisanal fisheries supplying Yemeni mother boats). Here, we focused specifically on discards in the shark fin fishery which have been estimated. In Somalia, dried shark meat was an export commodity, hence, sharks were not only targeted for their fins (Lovatelli 1996; Jennings 1998). In 2005, it was reported that dried shark meat was collected in Mogadishu from all regions and thereafter exported to Mombasa in Kenya (Sabriye 2005). In the mid-1990s, Lovatelli (1996) reported that only a small percent of fishers retained the meat, and Gulaid (2004) reported that only fins were retained by fishers in Somaliland. Thus, overall discards of sharks (except fins) were assumed to be relatively large. To estimate the shark discards in the small-scale fisheries, data from IUCN (2003) and Mohamed and Herzi (2005) were used. According to IUCN (2003), the

community of Eyl produced 200 t of shark fins, which requires about 10,000 t of live-weight sharks. In addition, Mohamed and Herzi (2005) stated that Eyl's estimated yearly locally landed and utilized shark catch (not finned) was 1,830 t in 2004. Thus, we assumed that the discards of shark meat in Eyl due to shark finning alone were about 8,170 t (10,000 t minus 1,830 t = 8,170 t), which was 69% of the total estimated shark and ray catch in 2004 in Eyl (8,170 t / 11,830 t = 0.69). In order to remain conservative, and also because the retained fin weight was not taken into account in this calculation, we reduced this to 49.1%, and used this as a total small-scale shark discard rate in 2004 for all of Somalia. Half of the 2004 discard rate was used as an anchor point in 1990 (i.e. 24.5%) to reflect the rapidly growing demand for shark fins reported during the 1990s (Clarke 2004). Thurow and Kroll (1962) reported that dried sharks were exported from Somalia and that shark fins fetched a higher price, however, there were no indications of shark meat discards in the report. Therefore, we conservatively assumed that shark discards were 0% in 1960. Linear interpolation was done between the 1960, 1990 and 2004 discard rates to derive the fraction of artisanal shark meat discards over time, and the 2004 rate was carried forward to 2010 unaltered.

Table 9. Breakdown for subsistence catches.

Taxon	Percentage (%)
Marine fishes nei	7.50
Scombridae	10.00
Clupeidae	2.04
Indian oil sardine	8.15
Carangidae	2.04
Bigeye scad	4.07
Arabian scad/Horse mackerel	4.07
Lethrinidae	8.15
Spangled emperor	16.30
Pink ear emperor	8.15
Long faced emperor	8.15
Lutjanidae	2.04
Aprion spp.	4.07
Serranidae	2.04
Areolate grouper	8.15
Mullidae	5.09

Adjustments

From 1992 to 1996, reported catches were greater than reconstructed catches. Therefore, catches in these years were assumed to be 100% reported (except for discards which are known to be unaccounted for in reported data) and a negative adjustment of the reported data was done. Previously, when the reported cephalopod catches were subtracted from the total artisanal and subsistence 'marine fishes nei', the result was a negative catch in these years (1992–1996). Therefore, the cephalopods were adjusted independently of the rest of the catch. All of the 'marine fishes nei' were assigned as cephalopods for 1992–1996 and the difference was allocated as a negative adjustment to the reported cephalopod catches. 'Tropical spiny lobster' catches were left unadjusted as they were assumed to be well reported. The remaining catch was compared to the 'marine fishes nei' reported catch. The difference between these totals represents the negative adjustment applied to the 'marine fishes nei' category of the reported data. Please note that all comparisons of reconstructed data to the reported FAO data refer to the adjusted baseline derived here.

Results

Reported catches

Total landings reported by FAO on behalf of Somalia were 922,930 t (944,999 t before adjustment) from 1950–2010, with catches varying between 5,000–15,000 t·year^{-1} from 1950 to the early 1980s, before increasing rapidly to around 25,000 t·year^{-1} by the early 1990s. Following a decline in landings during the 1990s, reported landings increased again to 30,000 t·year^{-1} in the early 2000s and have been fixed at this amount since (Figure 2A). Here, we split these data into assumed industrial and small-scale components of reported landings, and added unreported catches as well as discarding to both components.

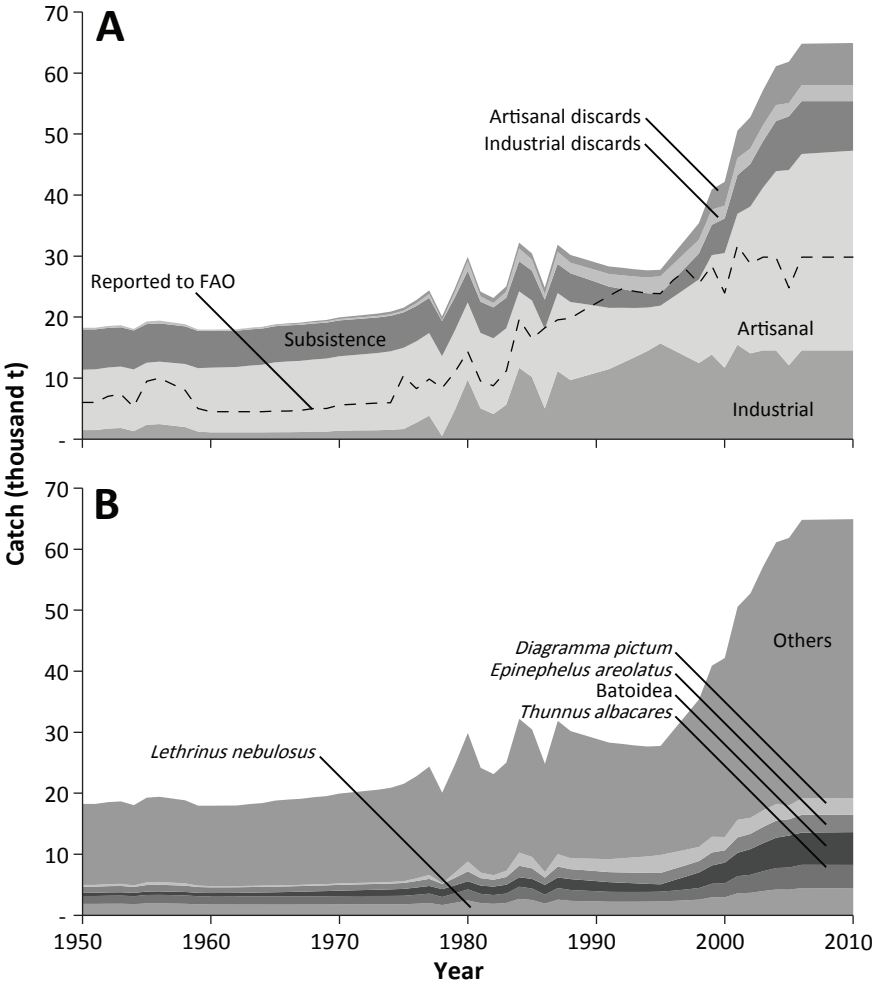

Figure 2. Reconstructed total catch in Somali waters, 1950–2010, A) by sector with reported catches overlaid as a dashed line, B) by major taxa. 'Others' includes 42 additional taxonomic categories. See Appendix Table A1 and Appendix Table A2 for details

Industrial catch

Of the total FAO reported landings, about 420,700 t, or 46%, were assigned to industrial landings from 1950–2010 (Figure 2A). Prior to 1975, industrial landings accounted for about 25% of total landings reported by Somalia to FAO. After the mid 1970s, industrial landings started to increase until 1995, when they peaked at around 15,700 t·year^{-1}, or 66% of total FAO reported landings (Figure 2A). The erratic nature of reported industrial landings, especially during the 1980s, was largely driven by serial failures of joint venture operations. The only source of unreported catch we examined and estimated for the industrial fishery was discards, which contributed 15% of the reconstructed total industrial catch (75,200 t).

The overall species composition of the industrial catches suggested that *Diagramma picta* was the most important individually identifiable taxon for the industrial fisheries (15.7%), consistently contributing between 14.5–16.1% of the catch each year. This was followed by *Lethrinus nebulosus* (9.3%) and *Epinephelus areolatus* (8.6%), while the most important pelagic species were yellowfin tuna (*Thunnus albacares*; 6.4%) and bigeye tuna (*Thunnus obesus*; 4.9%). Discards accounted to 15% of the reconstructed total industrial catches (Figure 2A).

Small-scale catch

Reconstructed total small-scale catches were over 1.3 million t for the entire period (Figure 2A), which was just over 2.6 times the volume of FAO landings assumed to represent small-scale catches. The reconstructed total small-scale catches during the colonial era (1950s) were estimated to be 16,500 t·year^{-1}. After 1960, total small-scale catches started to increase to almost 20,000 t·year^{-1} by 1977, before declining during the 1980s to about 18,500 t·year^{-1}. After the collapse of the national government in the early 1990s, catches dropped substantially to a low of 9,200 t·year^{-1} in 1995. Small-scale catches increased substantially thereafter to approximately 47,700 t·year^{-1} by the late 2000s. Small-scale catches were estimated to consist to 74% of artisanal catches and 26% subsistence catches. Discards contributed 10% to the overall artisanal catch.

The species breakdown of small-scale catches, based on information available to us, suggested that sharks and rays dominated catches. Their fraction of the landed artisanal catch (subsistence fisheries were assumed not to target sharks) increased from about 21% in the earlier period (2,100 t·year^{-1}), steadily rising from the mid-1960s to a peak of almost 54% in 1996 (4,600 t), and then declined to about 43% (14,000 t·year^{-1}) in the most recent years (2005–2010). Discards of shark meat (the result of targeted shark finning) were estimated at around 100,000 t between 1950 and 2010.

Although sharks and rays as a group were dominant in the small-scale catches, the most dominant individual taxa in the total small-scale catch were *Lethrinus nebulosus* (7.5%) and *Thunnus albacares* (6.1%).

Total catches

The reconstructed total catch was around 1.8 million t from 1950–2010, which was 98% larger than the adjusted landings of 922,930 t reported to FAO on behalf of Somalia for the same period (Figure 2A). For the first 20 years (1950–1969), reconstructed total catches averaged around 18,600 t·year^{-1}. During the 1970s and the 1980s, catches increased to around 22,000 t·year^{-1} and 28,000 t·year-1, respectively. After the government collapsed in 1991, total catches stabilized at 28,000 t·year^{-1} until 1995, before rapidly increasing to 41,000 t·year^{-1} by the end of the decade. This increase continued into the 21st century and levelled out at almost 65,000 t·year^{-1} after 2006.

The spangled emperor (*Lethrinus nebulosus*) and yellowfin tuna (*Thunnus albacares*) were the most prevalent species in the total reconstructed catch, contributing 8.0% and 6.2% respectively. Rays and mantas (Batoidea) made up 6.0%, whilst the areolate grouper (*Epinephelus areolatus*) was 5.1% of the total catch, followed by the painted sweetlip (*Diagramma pictum*) at 4.3% (Figure 2B).

Discussion

Since the early 1990s, Somalia has been a failed state without a functioning central government (Nincic 2008). The country is suffering extensively from poverty and violence, and its fisheries statistics are highly unreliable (Anon. 2001). Based on the information and data available to us, and the assumptions outlined in the methods, catches from 1950–2010 were reconstructed in an attempt to gain a better understanding of likely total Somali domestic catches. The reconstructed total catch estimates were nearly two times the data reported by FAO on behalf of Somalia, with reconstructed small-scale catches as the major contributor to the difference.

Interestingly, industrial catches showed an increase during the initial phase of the civil war instead of the expected decline. This reflects the loss of monitoring and enforcement capacity of Somalia during that time, which seems to have been taken advantage of by foreign vessels engaging in illegal fishing. Unlike industrial catches, the reconstructed small-scale catches were thought to better reflect the unstable situation in Somalia starting in the late 1980s, with a rapid decline after the collapse of the legitimate government in 1991. After this initial decline, small-scale catches started to increase substantially after 1995. Increased involvement and private investments in the domestic artisanal fisheries sector was the main reason for the observed increase in catches (Lovatelli 1996).

Other contributing factors could have been the change in seafood consumption habits among the Somalis (Gulaid 2004), the relocation of displaced people due to war, and the increased use of motorized boats by artisanal fishers (Anon. 2001).

The landings data reported by FAO on behalf of Somalia were for many years incomplete or highly uncertain. This is not surprising, given the lack of a central government and administration, and FAO is to be commended for being able to provide any estimates at all, given that national reporting of catches collapsed in the late 1980s due to civil unrest (Anon. 2001).

Foreign illegal and semi-illegal fishing

Since the Siad Barre regime collapsed in 1991 (and possibly even before that), Somalia has not been able to comprehensively patrol and protect its waters. Numerous vessels from various countries are thought to have exploited the situation by fishing illegally in Somali waters (e.g. Qayad 1997; Jennings 2001; Mwangura 2006b; Schofield 2008). There are contradictory reports about the number of illegal fishing vessels operating off the Somali coastline. Some of the more recent numbers suggest a decline from 500 foreign fishing vessels in 2006 (Mwangura 2006a) to 200 fishing vessels in 2009 (Anon. 2009c). However, exact numbers are not known due to the absence of monitoring and enforcement capacity within Somali waters. Furthermore, the number of foreign fishing vessels operating in Somali waters is also difficult to monitor due to the lack of transparency in data sharing among international monitoring agencies working in the Indian Ocean. As a matter of fact, misleading the public seems commonplace, as many fishing vessels, even while being attacked by Somali pirates, systematically withheld accurate position reports from relevant agencies, such as the International Maritime Bureau and International Maritime Organization, and these agencies avoid reporting positions in favour of likely dubious self-reporting by vessels (Hansen 2009). In contrast, the commercial MaRisk system, using position data collected *via* satellites and remote sensors from the military coalition fleet, showed that fishing vessels were deep within Somalia's EEZ when captured by pirates (Hansen 2009).

The autonomous, but unrecognized territories of Somaliland and Puntland had some limited success in controlling illegal fishing for short periods. For example, the Puntland administration assigned responsibility for controlling coastal resources to private security companies such as Hart Security (British) for 2000–2001, SOMCAN (United Arab Emirates) from 2001–2006, and Al Hababi Marine Services (Saudi Arabia) in 2006 (Hansen 2008). However, these initiatives met with limited success as most foreign vessels escaped into international waters whenever the private security vessels approached. Thus, for example, only four fishing vessels were arrested by Hart Security. None of the private security arrangements survived the interplay of local clan politics and changing political equations in these territories (Hansen 2008; Kinsey 2009).

It has been suggested that illegal foreign fishing in Somali waters has been the social reason for the resurgence of piracy in the region during the 2000s (Jennings 2001; Lehr and Lehmann 2007; Menkhaus 2009). Our catch reconstruction illustrates that domestic artisanal catches did decline after the start of the civil war and the collapse of central governance control. At the same time, foreign fishing fleets started to substantially increase their illegal fishing activities in Somali waters. The initial decline of artisanal catches was most likely caused by the lack of gear and boats, as well as the increased risk due to civil war, but might also have been impacted by the illegal foreign fleets. It has been reported that foreign vessels fished very close inshore and destroyed local fishing gears (Lehr and Lehmann 2007), which would have fuelled anger towards foreign fishers. Irrespective of the initial reasons and drivers for the resurgence of piracy, it did not take long for it to grow into big business for warlords and criminals utterly unrelated to domestic fisheries, who increasingly used foreign fishing as an excuse to hijack vessels and demand ransoms (Menkhaus 2009).

One example was the 'National Volunteer Coast Guard of Somalia' which in 2005 took over three Taiwanese-owned trawlers and demanded ransom for the crew, claiming it was a fine for fishing illegally within Somali waters (Lehr and Lehmann 2007). At the time (2005), the argument that pirates were deprived local fishers appeared to be already out of date, since our reconstruction suggests that by the mid-late 2000s, domestic artisanal fisheries catches had increased considerably. This is also supported by other observations (Gulaid 2004; Mohamed and Herzi 2005; Sabriye 2005). Therefore, the increasing piracy activities in the 2000s may have reduced illegal foreign fishing in coastal waters, permitting and enabling an increasing domestic artisanal sector to re-emerge.

Irrespective of the issue of piracy, the problem of foreign fishing fleets illegally exploiting Somali waters illustrates a severe failure of flag-state control, and further illustrates that illegal fishing is a matter of international, trans-boundary criminal activity rather than a fisheries management failure (Österblom *et al.* 2011; UNODC 2011). The value of illegal catches taken out of Somali waters in 2005 was estimated as being at least US$300 million (Lehr and Lehmann 2007). This lucrative illegal business is thought to have contributed to the prolongation of instability in the country, since neither foreign fishing interests or local authorities (warlords) would have benefited as much from properly controlled legal operations (Coffen-Smout 1998; Jennings 2001). Importantly, the value taken out of Somali waters by the illegal foreign fleets would not be available to the Somali people and society (David Ardill *pers. comm.*). In contrast, with fully transparent and legal licensing through foreign fishing access agreements, a functional national government would have been able to derive benefits for all of Somali society from one of their largest natural resources. Such controlled access would be an important source of foreign exchange income for legal national authorities, and may contribute to stability in the country (UNEP 2005).

If one examines semi-illegal fishing, i.e., foreign fishing based on 'licenses' and protection bought from local or regional authorities in contravention of international law, one finds that fishing companies that bought semi-illegal

licenses were often treading a thin line, as being licensed by one warlord or local authority did not ensure safe treatment by another if the vessel entered the perceived local territories of another warlord. Furthermore, the UN Monitoring Group on Somalia has documented misuse of revenues generated from the sale of semi-illegal fishing licenses to the benefit of local warlords to maintain militias and purchase weapons (UN 2006). This concern is not restricted to central and southern Somalia, but is also prevalent along the coast of Somaliland, where Yemeni vessels exchanged arms for fishing rights (UN 2008).

Conclusions

Overall, the likely total catches taken from the waters of Somalia by domestic vessels, as derived through our catch reconstruction, increased from 18,250 t in 1950 to 64,900 t in 2010, and total catches were 98% higher than officially reported data. The occurrence of extensive illegal foreign fishing in the waters of a sovereign state, mainly during a time of severe internal instability, although not quantified here, illustrates an astounding lack of flag-state control by predominantly European and Asian fleets, and a global failure of control over rampant unregulated fisheries exploitation. It seems a poor testimony of international affairs that, in the 21st century, the global community continues to be incapable or unwilling to act decisively in the interest of poor and developing countries. The clear show of unanimous inaction with respect to the renewable resources in the waters of Somalia can only be called 'commercial colonialisms' in the name of globalization and the pursuit of unfettered profit.

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References

Anon. (1982) Somali fishing industry has potential for growth. Foreign Fishery Developments, Marine Fisheries Review 44: 25–26.

Anon. (1985) Fisheries joint venture guidlines. Ministry of Fisheries and Marine Resources, Somali Democratic Republic, Mogadishu. 18 p.

Anon. (1987) Yearly fishery report 1986/87. Ministry of Fisheries and Marine Transport, Somali Democratic Republic, Mogadishu. 46 p.

Anon. (1988) Yearly fisheries and marine transport report 1987/1988. Ministry of Fisheries and Marine Transport, Somali Democratic Republic, Mogadishu.

Anon. (1998) Taiwanese fishermen fined for fishing in Somalia. Agence France Presse, February 28, 1998.

Anon. (2001) Strategic action programme for the Red Sea and Gulf of Aden. Country reports. Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), February 2001, Washington, D.C.

Anon. (2004) Somaliland in figures 2004. Ministry of National Planning and Coordination Republic of Somaliland, Hargesia. 101 p.

Anon. (2005) Two killed as Somalia hijackers clash over ransom. Awdal News, December 18, 2005.

Anon. (2008a) Kenya loses 10,000 tonnes of fish annually. The Standard, July 14, 2008.

Anon. (2008b) The MV Faina Piracy Crisis Chronicle — IX, News from abducted ships. Ecoterra News International, December 8, 2008.

Anon. (2008c) Official pirate-fishing in the Somali Indian Ocean flourishing. Mareeg Online, November 16, 2008.

Anon. (2008d) Pirate fishing boats target Africa. BBC News, July 3, 2008.

Anon. (2008e) Tanzania to curb illegal fishing. IPP Media, September 25, 2008.

Anon. (2009a) 40,000 tons of Yemen fish trafficked annually, Minister reveals. Yemen Post, November 9, 2009.

Anon. (2009b) Footprint factbook. Africa 2009. Securing human development in a resource constrained world., Global Footprint Network, October 2009, Oakland, California, United States of America. 123 p.

Anon. (2009c) Illegal EU vessels adding to piracy. Intrafish, edition of June 23, 2009.

Bakun A, Claude R and Lluch-Cota S (1998) Coastal upwelling and other processes regulating ecosystem productivity and fish production in the western Indian Ocean. Pp. 103–142 *In* Sherman K, Okemwa, E. N., and M. J. Ntiba (ed.), Large marine ecosystems of the Indian Ocean: assessment, sustainability and management. Blackwell Science, Oxford, U.K.

Bihi A (1984) L'impact potentiel des activités socio-économiques sur l'environnement marin et côtier de la région de l'Afrique de l'Est: rapports nationaux. PNUE : rapports et études des mers régionales n° 51.

Bultel E, Doherty B, Herman A, Le Manach F and Zeller D (this volume) An update of the reconstructed marine fisheries catches of Tanzania with taxonomic breakdown.

Clarke S (2004) Understanding pressures on fishery resources through trade statistics: a pilot study of four products in the Chinese dried seafood market. Fish and Fisheries 5: 53–74.

Coffen-Smout S (1998) Pirates warlords and rogue fishing vessels in Somalia's unruly seas. Available at: http://www.chebucto.ns.ca/~ar120/somalia.html [Accessed 13th October, 2009].

Colléter M, Darar Djibril A, Hosch G, Labrosse P, Yvergniaux Y, Le Manach F and Pauly D (this volume) Le développement soutenu de pêcheries artisanales : reconstruction des captures marines à Djibouti de 1950 à 2010.

Corfitzen W and Kinzy G (1950) Preliminary report on Somalia agricultural projects. Economic Cooperation Administration, September 8, 1950, Rome (Italy). 42 p.

Costello C, Kinlan BP, Lester SE and Gaines SD (2012) The economic value of rebuilding fisheries, OECD Food, Agriculture and Fisheries Working Papers, No. 55. OECD Publishing, Paris (France). 68 p.

Dupont B, Grabosky, P. and Shearing, C. (2003) The governance of security in weak and failing states. Criminal Justice 3(4): 19.

Elmer S (1985) Somalia; technical assistance for marketing and cooperatives. A report prepared for the Technical Support to the Ministry of Fisheries Project. Food and Agriculture Organization of the United Nations (FAO), Sweden Funds-In-Trust, Field Document 2, June 1985, Rome (Italy).

FAO (1972) Fishery resources survey Somali Democratic Republic. Report prepared for the Fishery Survey Project, based on the work of the research vessel Zheleznyakov. FI:SF/DP SOM 67/513/4. November 6 1972, Rome (Italy). 48 p.

FAO (1978) Development of fisheries in the exclusive economic zone of Somalia: report. Food and Agriculture Organization of the United Nations (FAO), 1978, Rome (Italy).

FAO (2005) The Somali Republic — General information. Food and Agriculture Organization of the United Nations (FAO), Rome (Italy). 10 p.

Gulaid A (2004) Feasibility report on the fisheries sector in Somaliland. Current status, opportunities and constraints., United Nations Development Programme (NDP). Discussion Paper Consultant's Findings, April–June 2004. 35 p.

Haakonsen J (1984) Scientific socialism and self-reliance. The case of Somalia'a "instant" fishermen. Department of Social Anthropology University of Bergen, 1984. 166 p.

Haakonsen JH (1983) Somalia's fisheries case study. FAO Fisheries Report No. 295, FIPP/R295, Food and Agriculture Organization of the United Nations, Rome (Italy).

Hansen SJ (2008) Private security & local politics in Somalia. Review of African Political Economy 118: 585–598.

Hansen SJ (2009) Piracy in the greater Gulf of Aden, myths, misconceptions and remedies. NIBR Report 2009, Norwegian Institute for Urban and Regional Research, Oslo (Norway). 72 p.

Hariri K (1985) Fisheries development in the North West Indian Ocean. The impact of commercial fishing arrangements. Ithaca Press, 1985, London (UK). 158 p.

IOFC (1982) Major fisheries issues in the region; progress and problems (and total landings). Food and Agriculture Organization of the United Nations (FAO), Indian Ocean Fishery Commission (IOFC), Committee for the Development and Management of Fisheries in the Southwest Indian Ocean, Second Session, 13–15 December 1982 Mahé (Seychelles).

IUCN (2003) Information on shark finning: conversion factors for shark fin to body weight., Available at: http://www.flmnh.ufl.edu/fish/organizations/ssg/finconversion.html [Accessed February 25, 2010].

IUCN (2006) Country environmental profile for Somalia. Prepared for the European Commission Somalia Operations Office by The World Conservation Union (IUCN), March–August 2006, Nairobi, Kenya.

Jennings T (1998) Marine living resource governance in the absence of a central authority: a study of Somalia. Master of Marine Affairs thesis, University of Washington, Seattle, WA (USA). 135 p.

Jennings T (2001) Controlling access in the absence of a central government: the Somali dilemma. Pp. 403–427 *In* Mann Borgese E, Chircop A and McConnell M (eds.), Ocean Yearbook 15. The University of Chicago Press, Chicago, IL (USA).

Johnsen T (1985) Commercial trawling for fish and deep sea lobster (*Puerulus spp.*) off Somalia. Food and Agriculture Organization of the United Nations (FAO). RAF/79/065/WP/13/84. June 1985.

Johnson R (1956) Fisheries reconnaissance Somalia, East Africa. United States of America operations mission to Italy, June 18, 1956, Rome (Italy). 29 p.

Kelleher K (1998) Approaches to marine fisheries governance in Somalia. Draft report, the protection and sustainable development of Somalia marine environment, seaports and coastal areas. United Nations Development Programme (UNDP), Project SOM/97/013A/08/19, Food and Agriculture Organization of the United Nations (FAO), FAO/TCP/SOM/6713, Field document. March 1998. 39 p.

Kelleher K (2005) Discards in the world's marine fisheries. An update. FAO Fisheries Technical Paper 470, Food and Agriculture Organization (FAO), Rome (Italy). 131 p.

Kinsey CP, Hansen, SJ and Franklin G (2009) The impact of private security companies on Somalia's governance networks. Cambridge Review of International Affairs 22(1): 15.

Kulmiye AJ (2001) Militia versus trawlers: Who is the villain? The East African Magazine, July 9, 2001.

Laitin D and Samatar S (1984) Somalia and the world economy. Review of African Political Economy 30: 58–72.

Lawrence C (1980) Fisheries legislation in Somalia. Food and Agriculture Organization of the United Nations (FAO), Rome (Italy).

Lawson T, Lablache G, Simeos F and Ali AF (1986) The Western Indian Ocean tuna fishery from 1980 to 1985 — A summary of data collected by coastal states. Technical Report, SFA/R & D/001, Seychelles Fishing Authority, 26 August 1986, Mahé (Seychelles).

Le Manach F, Abunge CA, McClanahan TR and Pauly D (this volume) Tentative reconstruction of Kenya's marine fisheries catch, 1950–2010.

Lehr P and Lehmann H (2007) Somalia–Pirates' new paradise. Pp. 1–21 *In* Lehr P (ed.), Violence at sea: piracy in the age of global terrorism. Taylor and Francis Group LLC, New York, NY (USA).

Losse G (1970) Fishery survey Somalia: the tuna fishery of the Gulf of Aden. Report prepared for the Government of Somalia by the Food and Agriculture Organization of the United Nations acting as executing agency for the United Nations Development Programme (UNDP), Technical Report 1, FI:SF/SOM 13, Rome (Italy).

Lovatelli A (1996) Artisanal fisheries final report. European Commission Rehabilitation Programme for Somalia. EC Somalia Unit, Nairobi (Kenya).

Marshall N (1997) The Somali shark fishery in the Gulf of Aden and the Western Indian Ocean. Pp. 24–30 *In* Marshall N, and R. Barnett (eds.), Trade in sharks and shark products in the Western Indian and Southeast Atlantic Oceans. TRAFFIC East/Southern Africa, Nairobi (Kenya).

Menkhaus K (2009) Dangerous waters. Survival 51: 21–25.

Mohamed M and Herzi M (2005) Feasibility report on the fisheries sector in Puntland. Current status, opportunities and constraints. United Nations Development Programme (UNDP) Somalia, Poverty Reduction and Economic Recovery. Ocean Training and Promotion (OTP) Bossaso supported by UNDP Somalia.

Mukhtar MH (1996) The plight of the agro-pastoral society of Somalia. Review of African Political Economy 23(70): 543–553.

Mwangura A (2006b) IUU fishing and Indian Ocean piracy. Workshop on Fishing Communities and sustainable Developments in Southern and Eastern Africa: A samll-scale fisheries perspective, Dar-es-Salaam (Tanzania).

Nincic D (2008) State failure and the re-emergence of maritime piracy. Presented at the 49th Annual Convention of the International Studies Association, March 26–29, 2008, San Francisco, CA (USA).

Ogilvie H, Fraser-Brunner A and Byrd D (1954) Report to the government of Italy as the administering authority for the Trust Territory of Somalia on the exploratory fishery survey in Somalia–1952/53. Food and Agriculture Organization of the United Nations (FAO), Rome (Italy). 83 p.

Österblom H, Constable A and Fukumi S (2011) Illegal fishing and the organized crime analogy. Trends in Ecology and Evolution 26(6): 261–262.

Pierconti G and Dunn I (1990) Fishery project formulation mission report. Intergovernmental authority on drought and development. Food and Agriculture Oraganization of the United Nations (FAO), FI:TCP/RAP/8970 (F), May 1990, Rome (Italy).

Qayad M (1997) Assessment mission to Somalia in connection with alleged dumping of hazardous substances. Mission report. Joint UNEP/DHA environmental unit and the UN coordination unit (UNCU) for Somalia, 10 May through 8 June, 1997.

Rykaczewski R and Checkley JD (2008) Influence of ocean winds on the pelagic ecosystem in upwelling regions. Proceedings of the National Academy of Science 105: 1965–1970.

Sabriye A (2005) Feasibility report on the fisheries sector in South and Central Somalia. Current status, opportunities and constraints., United Nations Development Programme (UNDP), poverty reduction and economic recovery. Discussion paper. 36 p.

Samatar AI (2007) Somalia's post-conflict economy: a political economy approach. Bildhaan 7(8): 43.

Samoilys M, Domingue G, Kariuki J, Payet R, Hersi A and Ali. M (2007) Application of the PROFISH global list of irresponsible fishing vessles as a tool to combat illegal unregulated and unreported fishing in Eastern Africa. The World Conservation Union, Nairobi (Kenya).

Sanders M and Morgan G (1989) Review of the fisheries resources of the Red Sea and Gulf of Aden. FAO Fisheries Technical Paper 304, Rome (Italy).

Schofield C (2008) Plundered waters; Somalia's maritime resource insecurity. Pp. 102–115 (332) *In* Doyle T, and M. Risely (eds.), Crucible for survival; environmental security and justice in the Indian Ocean region. Rutgers, New Jersey (USA).

Shaves G (1984) Somalia technical assistance for marketing and cooperatives. Sweden Funds-In-Trust, Food and Agriculture Organization of the United Nations (FAO). Prepared for the Technical Support to the Ministry of Fisheries Project. Field document, FI:UTF/SOM/028/SOM. Rome (Italy). 16 p.

Simoons FJ (1974) Rejection of fish as human food in Africa: a problem in history and ecology. Ecology of Food and Nutrition 3(2): 89–105.

Stromme T (1987) Annex IV Sectoral report on marine living resources. Pp. 87–110 *In* Burbridge P (ed.), Coastal and marine environmental problems of Somalia. UNEP Regional Seas Reports and Studies No. 84, UNEP.

Sumaila UR, Cheung WWL, Lam V, Pauly D and Herrick S (2011) Climate change impacts on the biophysics and economics of world fisheries. Nature Climate Change 1: 449–456.

Thurow F and Kroll D (1962) Report on the fisheries conditions in Somalia. Kiel (Germany). 36 p.

Tussing A, Hiebert RA and Sutinen J (1974) Fisheries of the Indian Ocean: issues of international management and law of the sea. Paper no. 5 in a series prepared for The Program of International Studies of Fishery Arrangements, Washington, DC (USA). 55 p.

UN (2006) United Nations Security Council, May 4, 2006, Report of the Monitoring Group on Somalia pursuant to Security Council resolution 1630 (2005). United Nations Security Council, United Nations. 69 p.

UN (2008) United Nations Security Council, April 24, 2008, Report of the Monitoring Group on Somalia pursuant to Security Council resolution 1766 (2007). United Nations Security Council. 83 p.

UNDP and FAO (1992) Development of inshore fisheries North West coast : Somalia: project findings and recommendations. United Nations Development Programme (UNDP) and Food and Agriculture Organization of the United Nations (FAO), Rome (Italy).

UNEP (2005) The state of the environment in Somalia. A desk study. United Nations Environment Programme (UNDP), Nairobi (Kenya). 67 p.

UNODC (2011) Transnational organized crime in the fishing industry. United Nations Office on Drug and Crime, Vienna (Austria). 140 p.

Van Zalinge NP (1988) Summary of fisheries and resources information for Somalia. Pp. 142–154 *In* Sanders MJ, Sparre P and Venema SC (eds.), Proceedings of the workshop on the assessment of the fishery resources in the Southwest Indian Ocean. Food and Agriculture Organization of the United Nations (FAO). FAO/UNDP: RAF/79/065/WP/41/88/E, Rome (Italy).

von Hoesslin K (2006) Taiwan and piracy along the Horn of Africa. Taiwan Journal XXV, Number 1.

Weir G (2009) Fish, family, and profit. Piracy and the Horn of Africa. *In* Elleman B, Forbes, A., and D. Rosenberg (eds.), Piracy and maritime crime: historical and modern case studies. Newport paper 35. Naval War College Press, New Port, RI (USA).

Yassin M (1981) Somali fisheries development and management. Report for the 506A Project Resource Management, Mogadishu (Somalia). 63 p.

Zeller D, Booth S, Davis G and Pauly D (2007) Re-estimation of small-scale fisheries catches for U.S. flag island areas in the Western Pacific: The last 50 years. Fishery Bulletin 105(2): 266–277.

Appendix Table A1. FAO landings vs. reconstructed total catch (in tonnes), and catch by sector, with discards shown separately, for Somalia, 1950–2010.

Year	FAO landings[a]	Reconstructed total catch	Industrial	Artisanal	Subsistence	Discards
1950	6,000	18,300	1,480	9,900	6,600	272
1951	6,000	18,300	1,480	9,960	6,550	272
1952	7,000	18,500	1,730	10,010	6,490	317
1953	7,400	18,700	1,830	10,070	6,440	335
1954	5,300	18,000	1,310	10,120	6,380	240
1955	9,500	19,300	2,340	10,170	6,330	430
1956	10,000	19,400	2,470	10,230	6,270	453
1957	9,000	19,100	2,220	10,280	6,220	407
1958	8,000	18,800	1,970	10,340	6,160	362
1959	5,000	18,000	1,230	10,390	6,110	226
1960	4,500	18,000	1,110	10,600	6,050	195
1961	4,500	18,000	1,110	10,660	6,000	213
1962	4,500	18,000	1,110	10,710	5,940	231
1963	4,500	18,200	1,110	10,930	5,930	249
1964	4,500	18,400	1,110	11,080	5,930	272
1965	4,600	18,800	1,130	11,450	5,920	289
1966	4,600	19,000	1,130	11,600	5,910	315
1967	4,700	19,100	1,160	11,670	5,910	353
1968	5,000	19,300	1,230	11,820	5,900	398
1969	5,000	19,500	1,230	11,970	5,880	435
1970	5,600	19,900	1,380	12,200	5,870	494
1971	5,700	20,200	1,410	12,350	5,860	537
1972	5,800	20,400	1,430	12,500	5,850	583
1973	5,900	20,600	1,460	12,660	5,830	631
1974	5,980	20,900	1,520	12,870	5,820	685
1975	10,350	21,500	1,650	13,320	5,800	766
1976	8,268	22,800	2,690	13,330	5,780	980
1977	9,830	24,400	3,850	13,530	5,770	1,225
1978	8,384	20,100	510	13,090	5,750	745
1979	10,984	24,700	4,780	13,010	5,460	1,495
1980	14,330	29,900	9,760	12,650	5,180	2,285
1981	9,523	24,200	5,040	12,360	5,120	1,648
1982	8,730	23,100	4,110	12,420	5,060	1,542
1983	11,195	25,000	5,640	12,530	5,000	1,869
1984	19,639	32,200	11,690	12,530	4,950	3,034
1985	16,467	30,400	10,180	12,540	4,890	2,828
1986	18,255	24,800	5,020	13,000	4,830	1,971
1987	19,546	31,900	11,150	12,780	4,770	3,154
1988	19,827	30,200	9,680	12,790	4,720	2,999
1989	21,046	29,600	10,270	11,900	4,300	3,090
1990	22,295	28,900	10,880	10,970	3,890	3,178
1991	23,500	28,300	11,470	10,040	3,490	3,295
1992	24,620	28,100	12,450	9,080	3,100	3,465
1993	24,212	27,800	13,420	8,070	2,720	3,623
1994	23,904	27,700	14,450	7,110	2,340	3,755
1995	23,851	27,800	15,690	6,180	1,980	3,900
1996	26,044	30,300	14,620	8,670	2,760	4,265
1997	27,750	32,800	13,540	11,180	3,520	4,606
1998	25,550	35,400	12,470	13,710	4,250	4,972
1999	28,400	40,900	13,860	16,290	4,970	5,798
2000	23,950	42,200	11,690	18,800	5,660	6,009
2001	31,700	50,600	15,470	21,460	6,330	7,295
2002	28,800	52,800	14,060	24,050	6,980	7,663
2003	29,800	57,200	14,540	26,700	7,610	8,369
2004	29,800	61,100	14,540	29,370	8,210	9,001
2005	24,800	61,800	12,100	32,000	8,790	8,947
2006	29,800	64,800	14,540	32,190	8,660	9,415
2007	29,800	64,800	14,540	32,320	8,520	9,444
2008	29,800	64,900	14,540	32,460	8,390	9,472
2009	29,800	64,900	14,540	32,590	8,250	9,501
2010	29,800	64,900	14,540	32,730	8,120	9,530

[a] These are the adjusted FAO landings.

Appendix Table A2. Reconstructed total catch (in tonnes) by major taxonomic group, for Somali, 1950–2010. 'Others' contain 42 additional taxonomic categories.

Year	*Lethrinus nebulosus*	*Thunnus albacares*	Batoidea	*Epinephelus areolatus*	*Diagramma pictum*	Others
1950	1,870	1,290	533	1,005	281	13,300
1951	1,860	1,290	536	1,002	281	13,300
1952	1,890	1,320	541	1,025	328	13,400
1953	1,890	1,330	545	1,032	347	13,500
1954	1,830	1,300	543	976	248	13,200
1955	1,940	1,390	555	1,081	445	13,900
1956	1,950	1,400	559	1,091	469	14,000
1957	1,910	1,390	560	1,062	422	13,800
1958	1,880	1,380	561	1,034	375	13,600
1959	1,790	1,330	557	954	234	13,100
1960	1,770	1,320	558	933	202	13,200
1961	1,760	1,330	565	931	202	13,200
1962	1,760	1,330	573	928	202	13,200
1963	1,750	1,340	608	926	197	13,400
1964	1,750	1,340	644	927	197	13,500
1965	1,750	1,340	681	922	187	13,900
1966	1,750	1,340	719	922	187	14,000
1967	1,760	1,350	759	927	197	14,100
1968	1,760	1,360	801	935	211	14,300
1969	1,760	1,360	844	935	211	14,400
1970	1,780	1,370	888	947	234	14,700
1971	1,780	1,370	933	949	239	14,900
1972	1,780	1,380	980	951	244	15,000
1973	1,780	1,380	1,027	953	248	15,200
1974	1,780	1,390	1,076	956	257	15,400
1975	1,800	1,400	1,129	971	285	16,000
1976	1,890	1,470	1,189	1,060	451	16,700
1977	2,010	1,540	1,251	1,165	646	17,800
1978	1,680	1,320	1,279	862	95	14,900
1979	2,040	1,560	1,308	1,230	839	17,800
1980	2,430	1,820	1,336	1,619	1,621	21,000
1981	1,990	1,520	1,348	1,223	910	17,200
1982	1,880	1,440	1,384	1,123	742	16,600
1983	2,020	1,550	1,443	1,267	1,018	17,700
1984	2,690	2,000	1,544	1,884	2,159	21,900
1985	2,510	1,870	1,578	1,724	1,881	20,900
1986	1,910	1,460	1,600	1,184	912	17,800
1987	2,560	1,900	1,724	1,793	2,042	21,800
1988	2,360	1,780	1,783	1,629	1,792	20,800
1989	2,320	1,720	1,723	1,636	1,901	20,300
1990	2,270	1,670	1,654	1,641	2,017	19,700
1991	2,220	1,620	1,586	1,642	2,128	19,100
1992	2,220	1,610	1,508	1,689	2,318	18,700
1993	2,230	1,600	1,419	1,741	2,513	18,300
1994	2,240	1,590	1,316	1,795	2,708	18,000
1995	2,270	1,600	1,201	1,868	2,938	17,900
1996	2,360	1,680	1,694	1,861	2,734	20,000
1997	2,450	1,780	2,128	1,857	2,530	22,100
1998	2,570	1,900	2,555	1,865	2,326	24,200
1999	2,950	2,220	2,994	2,121	2,585	28,000
2000	2,950	2,280	3,393	2,019	2,183	29,300
2001	3,600	2,810	3,832	2,522	2,890	34,900
2002	3,680	2,950	4,215	2,498	2,626	36,800
2003	3,980	3,250	4,599	2,668	2,717	40,000
2004	4,220	3,520	4,968	2,791	2,717	42,900
2005	4,200	3,620	5,239	2,667	2,263	43,900
2006	4,450	3,820	5,282	2,906	2,717	45,600
2007	4,440	3,830	5,304	2,899	2,717	45,600
2008	4,420	3,840	5,326	2,891	2,717	45,700
2009	4,410	3,850	5,348	2,883	2,717	45,700
2010	4,390	3,860	5,369	2,875	2,717	45,700